# CLAIMS

1. A method for producing an organic thin film in which an organic thin film is formed on a surface of a substrate, comprising a step (A) of bringing said substrate into contact with an organic solvent solution comprising a metal-based surfactant having at least one hydrolyzable group, and a catalyst capable of interacting with said metal-based surfactant, wherein a water content within said organic solvent solution is either set or maintained within a predetermined range.

2. A method for producing an organic thin film according to claim 1, wherein said organic solvent solution is prepared by using from 0.001 to 1 mol, or an oxide-equivalent quantity of 0.001 to 1 mol, of said catalyst capable of interacting with said metal-based surfactant, per 1 mol of said metal-based surfactant.

3. A method for producing an organic thin film in which an organic thin film is formed on a surface of a substrate, comprising a step (A) of bringing said substrate into contact with an organic solvent solution comprising a metal-based surfactant having at least one hydrolyzable group, and a catalyst capable of interacting with said metal-based surfactant, wherein a water content within said organic solvent solution is maintained within a predetermined range, and said step (A) is repeated at least two times using an identical solution.

4. A method for producing an organic thin film according to claim 3, wherein in repeating said step (A) two or more times, said step (A) is conducted with two or more substrates using an identical solution.

5. A method for producing an organic thin film according to any one of claim 1 through claim 4, further comprising a step (B) of washing said substrate following said step (A).

6. A method for producing an organic thin film according to any one of claim 1 through claim 5, further comprising a step (C) of heating said substrate following said step (A).

7. A method for producing an organic thin film according to claim 6, further comprising a step (B) of washing said substrate following said step (A), but prior to said step (C).

8. A method for producing an organic thin film according to any one of claim 1 through claim 7, wherein by providing a water layer that contacts said organic solvent solution, a water content within said organic solvent solution is either set or maintained within a predetermined range.

9. A method for producing an organic thin film according to any one of claim 1 through claim 8, wherein by incorporating a water-retentive material in a hydrated state within said organic solvent solution, a water content within said organic solvent solution is either set or maintained within a predetermined range.

10. A method for producing an organic thin film according to claim 9, wherein said water-retentive material is a glass fiber filter.

11. A method for producing an organic thin film according to any one of claim 1 through claim 10, wherein by blowing a gas containing moisture through said organic solvent solution, a water content within said organic solvent solution is either set or maintained within a predetermined range.

12. A method for producing an organic thin film according to any one of claim 1 through claim 11, wherein a water content within said organic solvent solution is either set or maintained within a range from 50 to 1,000 ppm.

13. A method for producing an organic thin film according to any one of claim 1 through claim 12, wherein a water content within said predetermined range is a measured

value, obtained by a Karl Fischer method, for a solution aliquot sampled from said organic solvent solution.

14. A method for producing an organic thin film according to any one of claim 1 through claim 13, wherein said catalyst capable of interacting with said metal-based surfactant is at least one material selected from a group consisting of metal oxides; metal hydroxides; metal alkoxides; chelated or coordinated metal compounds; partial hydrolysis products of metal alkoxides; hydrolysis products obtained by treating a metal alkoxide with a two-fold or greater equivalence of water; organic acids; silanol condensation catalysts; and acid catalysts.

15. A method for producing an organic thin film according to claim 14, wherein a compound with a pKa value within a range from 1 to 6 is used as said organic acid.

16. A method for producing an organic thin film according to claim 14, wherein said partial hydrolysis product of a metal alkoxide is able to be stably dispersed in an organic solvent without aggregating, even in absence of acids, bases, and/or dispersion stabilizers.

17. A method for producing an organic thin film according to either one of claim 14 and claim 16, wherein said partial hydrolysis product of a metal alkoxide is a product obtained by hydrolyzing a metal alkoxide in an organic solvent, using from 0.5 to less than 2.0 mols of water per 1 mol of said metal alkoxide, at a temperature within a range from -100°C to a reflux temperature of said organic solvent.

18. A method for producing an organic thin film according to any one of claim 14 through claim 17, wherein a metal within said metal oxide; metal hydroxide; metal alkoxide; chelated or coordinated metal compound; partial hydrolysis product of a metal alkoxide; or hydrolysis product obtained by treating a metal alkoxide with a two-fold or greater equivalence of water is one or more metals selected from a group consisting of

titanium, zirconium, aluminum, silicon, germanium, indium, tin, tantalum, zinc, tungsten, and lead.

19. A method for producing an organic thin film according to any one of claim 1 through claim 18, wherein said metal-based surfactant having at least one hydrolyzable group is a compound represented by a formula (I) shown below:

$$R^1_nMX_{m-n} \qquad (I)$$

(wherein, $R^1$ represents a hydrocarbon group that may contain a substituent, a halogenated hydrocarbon group that may contain a substituent, a hydrocarbon group containing a linkage group, or a halogenated hydrocarbon group containing a linkage group, M represents at least one metal atom selected from a group consisting of a silicon atom, germanium atom, tin atom, titanium atom, and zirconium atom, X represents a hydroxyl group or a hydrolyzable group, n represents an integer from 1 to (m-1), m represents an atomic valence of said metal M, and in those cases where n is 2 or greater, said $R^1$ groups are either identical or different, and in those cases where (m-n) is 2 or greater, said X groups are either identical or different, although of (m-n) X groups, at least one X group is a hydrolyzable group).

20. A method for producing an organic thin film according to any one of claim 1 through claim 18, wherein said metal-based surfactant having at least one hydrolyzable group is a compound represented by a formula (II) shown below:

$$R^2_3C\text{-}(CR^3_2)_p\text{-}R^4_q\text{-}MY_rX_{m-r-1} \qquad (II)$$

(wherein, M represents at least one metal atom selected from a group consisting of a silicon atom, germanium atom, tin atom, titanium atom, and zirconium atom, X represents a hydroxyl group or a hydrolyzable group, $R^2$ and $R^3$ each represent, independently, a hydrogen atom or a fluorine atom, $R^4$ represents an alkylene group, vinylene group, ethynylene group, arylene group, or a bivalent linkage group that contains a silicon atom

and/or an oxygen atom, Y represents a hydrogen atom, or an alkyl group, alkoxy group, fluorine-containing alkyl group, or fluorine-containing alkoxy group, p represents either 0 or a natural number, q represents either 0 or 1, r represents an integer from 0 to (m-2), and in those cases where r is 2 or greater, said Y groups are either identical or different, and in those cases where (m-r-1) is 2 or greater, said X groups are either identical or different, although of (m-n-1) X groups, at least one X group is a hydrolyzable group).

21. A method for producing an organic thin film according to any one of claim 1 through claim 20, wherein said hydrolyzable group of said group X is a halogen atom, an alkoxy group of C1 to C6, or an acyloxy group.

22. A method for producing an organic thin film in which an organic thin film is formed on a surface of a substrate, comprising a step of bringing said substrate into contact with an organic solvent solution comprising a metal-based surfactant having at least one hydroxyl group, wherein a water content within said organic solvent solution is either set or maintained within a predetermined range.

23. A method for producing an organic thin film according to claim 22, wherein a water content within said organic solvent solution is either set or maintained within a range from 50 to 1,000 ppm.

24. A method for producing an organic thin film according to either one of claim 22 and claim 23, wherein said metal-based surfactant having at least one hydroxyl group is a compound represented by a formula (III) shown below:

$$R^1{}_nMX_{m-n-1}(OH) \qquad \text{(III)}$$

(wherein, $R^1$ represents a hydrocarbon group that may contain a substituent, a halogenated hydrocarbon group that may contain a substituent, a hydrocarbon group containing a linkage group, or a halogenated hydrocarbon group containing a linkage group, M represents at least one metal atom selected from a group consisting of a silicon atom,

germanium atom, tin atom, titanium atom, and zirconium atom, X represents a hydroxyl group or a hydrolyzable group, n represents an integer from 1 to (m-1), m represents an atomic valence of said metal M, and in those cases where n is 2 or greater, said $R^1$ groups are either identical or different, and in those cases where (m-n-1) is 2 or greater, said X groups are either identical or different).

25. A method for producing an organic thin film according to any one of claim 1 through claim 24, wherein said step of bringing said substrate into contact with said organic solvent solution is conducted within a space that is maintained at a humidity of at least 40% RH.

26. A method for producing an organic thin film according to any one of claim 1 through claim 24, wherein said step of bringing said substrate into contact with said organic solvent solution is conducted within a space that is maintained at a humidity of at least 60% RH.

27. A method for producing an organic thin film according to any one of claim 1 through claim 26, wherein said organic solvent solution is a hydrocarbon-based solvent solution or a fluorinated hydrocarbon-based solvent solution.

28. A method for producing an organic thin film according to any one of claim 1 through claim 27, wherein said organic thin film is a crystalline organic thin film.

29. A method for producing an organic thin film according to any one of claim 1 through claim 28, wherein said organic thin film is a monomolecular film.

30. A method for producing an organic thin film according to any one of claim 1 through claim 29, wherein a substrate containing active hydrogen at a surface is used as said substrate.

31. A method for producing an organic thin film according to any one of claim 1 through claim 30, wherein said substrate comprises at least one material selected from a group consisting of glass, silicon wafers, ceramics, metals, and plastics.

32. A method for producing an organic thin film according to any one of claim 1 through claim 31, wherein said organic thin film is a chemically adsorbed film.

33. A method for producing an organic thin film according to any one of claim 1 through claim 32, wherein said organic thin film is a self-assembly film.

34. A method for producing an organic thin film according to any one of claim 1 through claim 33, wherein in said organic solvent solution, said metal-based surfactant having at least one hydrolyzable group or said metal-based surfactant having at least one hydroxyl group forms an aggregate.

35. A self-assembly film forming solution for forming a self-assembly film on a surface of a substrate, wherein molecules for forming said self-assembly film form an aggregate within said solution.

36. A self-assembly film forming solution according to claim 35, wherein molecules for forming said self-assembly film are molecules of either a metal-based surfactant having at least one hydroxyl group or hydrolyzable group, or a derivative thereof.

37. A self-assembly film forming solution according to either one of claim 35 and claim 36, wherein said aggregate is obtained by treating a metal-based surfactant having at least one hydroxyl group or hydrolyzable group with a catalyst capable of interacting with said metal-based surfactant, and water.

38. A self-assembly film forming solution according to any one of claim 35 through claim 37, wherein said metal-based surfactant having at least one hydroxyl group or hydrolyzable group is a compound represented by a formula (IV) shown below:

$$R^{11}{}_{n1}M^{1}X^{1}{}_{m1-n1} \qquad \text{(IV)}$$

(wherein, $R^{11}$ represents a hydrocarbon group that may contain a substituent, a halogenated hydrocarbon group that may contain a substituent, a hydrocarbon group containing a linkage group, or a halogenated hydrocarbon group containing a linkage group, $M^1$ represents at least one metal atom selected from a group consisting of a silicon atom, germanium atom, tin atom, titanium atom, and zirconium atom, $X^1$ represents a hydroxyl group or a hydrolyzable group, $n_1$ represents an integer from 1 to $(m_1-1)$, $m_1$ represents an atomic valence of said metal $M^1$, and in those cases where $n_1$ is 2 or greater, said $R^{11}$ groups are either identical or different, and in those cases where $(m_1-n_1)$ is 2 or greater, said $X^1$ groups are either identical or different).

39. A self-assembly film forming solution according to any one of claim 35 through claim 37, wherein said metal-based surfactant having at least one hydroxyl group or hydrolyzable group is a compound represented by a formula (V) shown below:

$$R^{21}{}_3C\text{-}(CR^{31}{}_2)_{p1}\text{-}R^{41}{}_{q1}\text{-}M^2Y^2{}_{r2}X^2{}_{m2-r2-1} \qquad (V)$$

(wherein, $M^2$ represents at least one metal atom selected from a group consisting of a silicon atom, germanium atom, tin atom, titanium atom, and zirconium atom, $X^2$ represents a hydroxyl group or a hydrolyzable group, $R^{21}$ and $R^{31}$ each represent, independently, a hydrogen atom or a fluorine atom, $R^{41}$ represents an alkylene group, vinylene group, ethynylene group, arylene group, or a bivalent linkage group that contains a silicon atom and/or an oxygen atom, $Y^2$ represents a hydrogen atom, or an alkyl group, alkoxy group, fluorine-containing alkyl group, or fluorine-containing alkoxy group, $p_1$ represents either 0 or a natural number, $q_1$ represents either 0 or 1, $r_2$ represents an integer from 0 to $(m_2-2)$, and in those cases where $r_2$ is 2 or greater, said $Y^2$ groups are either identical or different, and in those cases where $(m_2-r_2-1)$ is 2 or greater, said $X^2$ groups are either identical or different).

40. A self-assembly film forming solution according to any one of claim 35 to claim 39, wherein said hydrolyzable group is a halogen atom, an alkoxy group of C1 to C6, or an acyloxy group.

41. A self-assembly film forming solution according to any one of claim 35 to claim 40, wherein an average particle diameter of said aggregate is within a range from 10 to 1,000 nm.

42. A self-assembly film forming solution according to any one of claim 35 to claim 41, wherein a zeta potential of said aggregate is equal to or greater than a zeta potential of said substrate within an identical solution.

43. A method for producing an organic thin film according to any one of claim 1 through claim 33, wherein said substrate is not crystalline, and said organic thin film is crystalline.

44. A chemically adsorbed film formed on a substrate, wherein said substrate is not crystalline, and said chemically adsorbed film is crystalline.

45. A chemically adsorbed film according to claim 44, which is formed using a metal-based surfactant having at least one hydroxyl group or hydrolyzable group.

46. A chemically adsorbed film according to either one of claim 44 and claim 45, wherein said chemically adsorbed film is a monomolecular film.

47. A chemically adsorbed film according to any one of claim 44 through claim 46, wherein said chemically adsorbed film is a self-assembly film.

48. A method for producing an organic thin film according to any one of claim 1 through claim 33, wherein said step for bringing said organic solvent solution into contact with said substrate is a step in which at least one method selected from a group consisting of dipping methods, spin coating methods, roll coating methods, Meyer bar methods,

screen printing methods, offset printing methods, brush coating methods, and spray methods is used to apply said organic solvent solution to said substrate.

49. A method for producing a monomolecular film, comprising a step of applying an organic solvent solution comprising a metal-based surfactant having a hydroxyl group, hydrocarbonoxy group, or acyloxy group to a substrate, using at least one method selected from a group consisting of dipping methods, spin coating methods, roll coating methods, Meyer bar methods, screen printing methods, offset printing methods, brush coating methods, and spray methods.

50. A method for producing a monomolecular film, wherein an organic solvent solution containing a metal-based surfactant having a hydroxyl group, hydrocarbonoxy group, or acyloxy group is dripped onto a substrate, and pressure is then applied from above said dripped solution to spread said solution across said substrate.

51. A method for producing a monomolecular film according to claim 50, wherein a method for applying pressure from above said dripped solution is a method in which a film, a sheet, or a flat plate is laid on top of a surface of said substrate, and then rolled.

52. A method for producing a monomolecular film according to any one claim 49 through claim 51, wherein a step of washing said substrate is provided following an application step.

53. A method for producing a monomolecular film according to any one of claim 49 through claim 52, wherein a step of heating said substrate is provided following an application step.

54. A method for producing a monomolecular film according to any one of claim 49 through claim 53, wherein said organic solvent solution comprising said metal-based surfactant also comprises a catalyst capable of interacting with said metal-based surfactant.